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Marketing Research Report No. 654

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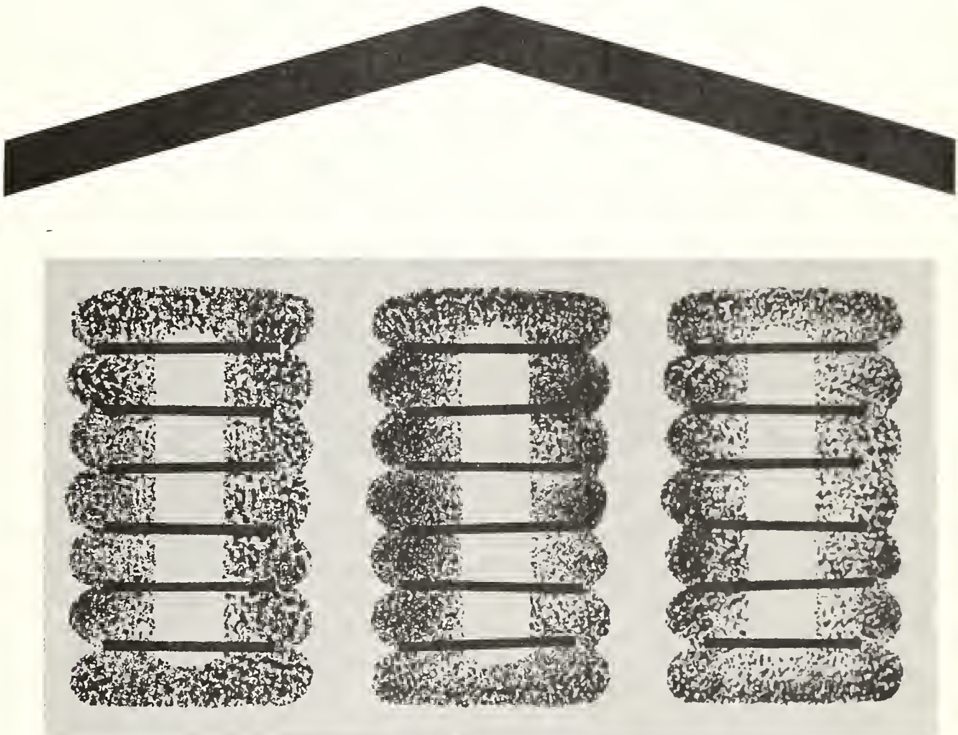
Comparison of

Mechanically Drawn Samples With Cut Samples for Evaluating Cotton Quality



U. S. Department of Agriculture • Economic Research Service and Agricultural Marketing Service

PREFACE

This publication reports the findings of the second phase of a two-part study of the effects of storage on the quality of baled cotton. It shows the usefulness of various types of samples for evaluating quality of cotton immediately after ginning and after 2 years of storage.

The findings of the first report are in: Changes in Quality and Value of Cotton Bales and Samples During Storage, U.S. Department of Agriculture, Marketing Research Report No. 645.

The assistance of ginners, warehousemen, marketing firms, and staff members of the Commodity Credit Corporation in the selection, assembly, and storing of cotton bales and samples used in this study is gratefully acknowledged. The authors also wish to thank their colleagues for helpful suggestions and advice in planning the study, analyzing the data, and summarizing the findings.

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Washington, D.C. April 1964

SUMMARY AND CONCLUSIONS

Although mechanical sampling does not deface the appearance of the bale as other types of sampling and could bring about greater efficiency in merchandising, mechanical samplers are installed in only about 3 percent of all gins in the Cotton Belt. The general lack of acceptance of mechanical samples is due primarily to the uncertainties of firms at all stages of merchandising as to whether grade, staple length, and other quality characteristics of a mechanical sample differ significantly from those of a cut sample from the same bale.

To help resolve this uncertainty, a study was initiated in 1959 to compare mechanically drawn samples with samples cut from the same bales for determining initial grade, staple length, and other quality attributes, and to ascertain the usefulness of stored mechanical samples for evaluating quality changes in bales also stored for a period of 2 years. A total of 800 bales were included in this study. There were 300 gin flat bales from the Texas High Plains, and 300 gin flat and 200 gin standard bales from the San Joaquin Valley of California.

The results indicate that, on the average, mechanical samples drawn during ginning were just about as reliable and useful for merchandising purposes as cut samples taken immediately after ginning. For all 800 bales studied, the average bale value and average grade were slightly higher and average staple length was slightly lower for mechanical samples than for cut samples. However, average values differed by only 10 cents per bale, and none of the differences were statistically significant.

Average differences often were greater for groups of bales of particular types or from particular origins; however, differences between types of samples were not consistent, varying among groups both in extent and direction. This lack of consistency reflects variations among different types of cotton, among cut samples from different types of bales, among classers in their relative evaluation of different types of samples, or in other factors. For example, the two types of samples were assigned identical grades for about three-fourths of the gin flat bales from Texas and California, and for about half of the gin standard bales. Mechanical samples were assigned higher grades for about two-thirds of the remaining Texas bales, lower grades for about four-fifths of the remaining California flat bales, and higher grades for about four-fifths of the remaining gin standard bales. In terms of average grade, the differences were statistically significant for each of the three groups of bales, whereas differences in average staple length were not significant.

Average value based on mechanical samples from the Texas bales was 35 cents a bale higher than the average value based on cut samples. Statistically, this difference was not significant. For California flat bales, value based on mechanical samples averaged 65 cents a bale less than the value based on out samples, whereas for gin standard bales, value of mechanical samples averaged 90 cents a bale higher than for cut samples. Statistically, these two differences were highly significant.

Difference between mechanical and cut samples with respect to color, fiber, processing, and dyeing properties were generally minor, inconsistent, and not significant. Thus, except for grade classification, mechanical samples were equal to cut samples for reflecting initial quality characteristics of cotton.

Differences between qualities and values based on mechanical samples stored 2 years and fresh samples cut from corresponding bales also stored 2 years were more marked than differences found when comparisons were made shortly after cotton

was ginned. These differences suggest that mechanical samples stored for extended periods cannot be used successfully under existing marketing practices for merchandising cotton. The two types of samples were assigned identical grades for 45, 52, and 68 percent of the Texas flat and California flat and gin standard bales, respectively. However, from 27 to 45 percent of the stored mechanical samples from each group were assigned lower grades than were assigned to freshly cut samples. Differences in average grade, and in average reflectance and yellowness, between the two sets of samples were statistically significant for each group of bales and for all bales combined.

Average staple length of stored mechanical samples was significantly lower than that of freshly cut samples from the Texas bales, whereas for the two groups of California bales the differences between the two types of samples were negligible. Value based on stored mechanical samples was less than that based on freshly cut samples by $3.55 a bale for Texas cotton, and by $1.25 and $1.05 a bale for California flat and gin standard bales, respectively.

Differences between stored mechanical and fresh samples for grade, staple length, color, and value were greater for bales stored in Houston, Tex., than for bales of the same origin and density stored in either Lubbock, Tex., or Bakersfield, Calif., and differences were greater for compress-standard bales than for flat or gin standard bales.

Except for nep count, differences in fiber and results of processing between the two types of samples were negligible and inconsistent. Stored mechanical samples averaged 22 neps per 100 square inches of card web compared to an average of 29 neps for freshly cut samples.

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COMPARISON OF MECHANICALLY DRAWN SAMPLES WITH CUT SAMPLES FOR EVALUATING COTTON QUALITY

C. Curtis Cable, Jr., Harvin R. Smith, and Zolon M. Looney 1/

PROBLEM AND OBJECTIVES OF STUDY

Mechanical devices for sampling cotton as it is being ginned were developed primarily to provide a more representative sample, and to correct unsatisfactory conditions resulting from the conventional practice of cutting samples from bales after packaging at the gin. Cut samples are criticized because they consist of only two portions that are obtained from the outer layer of the two sides of a bale. Thus these samples may not represent the entire contents of the bale. Other major objections to cutting samples are (1) mutilation of the bale covering, and the resulting unsightly appearance of the bale; (2) a loss in the value of the bale due to excess cotton removed; and (3) the contamination of lint near the bale surface (1, 2, 11, 12). 2/

To a great extent, mechanical samplers now in use have overcome these objections (7, 9). In addition, the mechanical sample as drawn and packaged at the gin may be divided into two or three segments, or subsamples. One of these subsamples may be used for determining the Smith-Doxey classification, and the remaining ones may be held for the use of the first buyer or stored until needed for future merchandising purposes (11).

The manufacture and use of mechanical cotton samplers began in 1955. By the beginning of the 1961-62 ginning season, 195 mechanical samplers had been installed (5). This indicates that some producers and marketing firms have accepted mechanically drawn samples, and that they apparently feel this method of sampling offers opportunities for improvements in cotton packaging and merchandising methods.

However, many industry leaders are opposed to mechanical sampling of cotton for various reasons. Some may have a natural tendency to resist changes and adjustments in operations associated with technological developments. Also, many firms are uncertain as to whether grade, staple length, and other quality characteristics based on a mechanical sample differ significantly from those based on a cut sample from the same bale.

To help resolve this uncertainty, the U.S. Department of Agriculture initiated a study in the fall of 1959 to obtain basic information on the comparative quality measurements of mechanically drawn and cut samples from the same bales. The specific objectives of this study were to (1) compare mechanically drawn samples with cut samples for determining initial grade, staple length, color, and other quality characteristics of cotton, and (2) ascertain the usefulness of mechanical samples stored 2 years for evaluating quality changes in bales also stored for a period of 2 years.

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2/ Underscored figures in parentheses refer to items in Literature Cited. p. 23.

Review of Previous Research

Results of several tests comparing mechanically drawn samples to cut samples for determining initial quality of bales are summarized in a report by Cooper, Campbell, and Pritchard (2). They report that two different tests made in the early 1950's indicate that experimental mechanical samplers are satisfactory for classification purposes. Results of a third test based on samples obtained during the 1955-56 season by a California ginner led the authors (2) to the same general conclusion.

Shaw and Franks (10) reported results of similar tests made in evaluating a new type of mechanical sampler recently developed at the U.S. Cotton Ginning Research Laboratory, Stoneville, Miss. In one test made at Stoneville in 1957, three types of samples from 54 bales were compared: a mechanical sample, a hand sample taken directly from the lint slide, and a conventionally cut sample. In summarizing the results of this particular test, the authors stated, "These data do serve to show that the classification differences for the automatic sampler fall within the range of human error of classers, but there is a trend of slightly higher grade and lower staple length associated with the samples taken by the automatic sampler."

Data for another test summarized in the same report (10) were obtained in New Mexico in 1958. A mechanical sampler was installed in a 5-stand, 80-saw gin to test its performance under commercial operating conditions. Comparative samples, mechanical and cut, were taken from several bales for each of five different time periods from September 23 to October 31. For all 93 bales included in the test, grade index averaged 97 (SLM+) for both types of samples. Staple length was shorter by less than 0.1 of 1/32 of an inch for the mechanical samples; however, fibrograph test data did not confirm this difference in fiber length. Differences in reflectance, yellowness, and neps between the two types of samples were negligible.

Most of the previous comparisons of mechanical samples to conventional cut samples were made in connection with laboratory models of experimental samplers. Also, relatively limited numbers of bales were used, or samples were not obtained from the same bales. Such restrictions on testing procedure may greatly limit the acceptance of findings by commercial cotton firms. Because of limitations of previous tests, it was felt that a more extensive evaluation of mechanical samples as obtained and used in commercial operations was warranted.

Method and Limitations of Study

A total of 800 bales were selected for this study at time of ginning in 1959. Two hundred were gin standard density bales selected from one California gin. Six hundred were packaged flat bales, 300 of them from a gin in the Texas High Plains and 300 from a gin in the San Joaquin Valley of California. Half of the bales from each gin were selected from early-season ginnings and half from the late-season crop.

A mechanical sample was obtained from each bale during the ginning process. One segment of this sample was classed soon after ginning. Another segment was stored for 2 years in the warehouse along with the bale from which it was obtained.

Within 1 to 3 days after ginning, two samples were cut from each of the 800 bales. Quality data based on mechanical samples were compared with quality data based on one of these cut samples to show the extent to which the indicated quality of producers' cotton may vary due to type of sample submitted for Smith-Doxey classification.

After this initial sampling, 400 gin flat bales were compressed to standard density, and one sample was cut from each of them. These samples and mechanical samples from corresponding bales were evaluated to determine whether, from the standpoint of merchandising, the classifications assigned to mechanical samples differed significantly from the classifications assigned to samples cut from bales soon after compression.

After the mechanical samples and the bales from which they were taken had been stored for 2 years, samples were cut from the stored bales. The mechanical samples and those freshly cut were analyzed to ascertain how accurately the stored mechanical samples reflected changes in quality which occurred in baled cotton during 2 years of storage.

The 800 bales were divided into lots of 100 bales each. They were then stored in selected locations in order to ascertain the effect that storage location, in addition to bale density, had on the usefulness of stored mechanical samples for evaluating quality of stored bales. The storage location and density of bales when stored, by origin, were as follows:

Origin	Storage location	Bale density
Texas	Lubbock	Gin flat
Texas	Lubbock	Compress standard
Texas	Houston	Compress standard
California	Bakersfield	Gin flat
California	Bakersfield	Compress standard
California	Houston	Compress standard
California	Bakersfield	Gin standard
California	Houston	Gin standard

It is very difficult to accurately measure differences between mechanical and cut samples. Because of possible variation in quality characteristics within individual bales, some of the differences between mechanical and cut samples found in this study may have been due to actual differences in the portions of the bale from which the two types of samples were obtained. Secondly, some of the difference in grade and staple length may be attributed to the conventional method of classing cotton, which even if done by the most competent classer, is always subject to human error. 3/

An indication of the extent to which variations in sampling and classing may have affected the results of this study was revealed by comparing the quality data based on the two similar samples cut from each bale soon after ginning. Identical grades were assigned to these two samples for 73 percent of the 800 bales; these samples were assigned the same grades for 83 percent of the 300 Texas bales and 67 percent of the 500 California bales. For the other bales, the differences tended to balance out. As measured by average grade value, differences in grade designations between these two cut samples were equivalent to 10 cents a bale for the Texas cotton (appendix, table 12). 4/ There was no difference for the California bales. Differences in staple length and color were also negligible and not significant.

3/ A detailed explanation of the more probable reasons for classing variations which may result in considerable difference among reputable classers is contained in: "Influence of Certificated Stocks on Spot-Futures Price Relationships for Cotton (8, pp. 13-18).

4/ As used in this study, grade value represents the effect that grade alone had on value with staple length held constant at 1 inch.

Compression affected the classification and color evaluation of bales. For the 400 compressed bales, grade value based on compressed-bale cut samples averaged 25 cents a bale greater than that based on flat-bale cut samples (appendix, table 13). This difference was substantiated by significant differences in color; average reflectance was higher, and average yellowness was lower after compression than before.

Uniformity of cotton with respect to certain quality characteristics in one area as compared with the lack of uniformity in another area may also affect the classifications and other measurements of quality obtained from different types of samples. For example, all 500 bales of California cotton were assigned a staple length of 1-1/16 inches on the basis of both identical cut samples (appendix, table 12). In contrast, the staple length of the Texas cotton varied from 13/16 to 1-1/16 inches, and there were few instances in which the duplicate cut samples were assigned identical staple lengths.

Although these and possibly other causes of variation in quality evaluations are known to exist, no established and acceptable means have been developed to eliminate them. However, it was felt that comparative samples from 800 bales produced and ginned in two different areas and encompassing a wide range in quality characteristics were sufficient to minimize differences due to normal variations, and that the differences found in this study were reliable indicators of actual differences due to type of sample.

MECHANICAL SAMPLES COMPARED WITH SAMPLES CUT FROM GIN-PACKAGED BALES

Grade, Staple Length, and Value

Considering the 800 bales as a group, there was relatively little difference between the distribution of grades based on mechanically drawn samples and that based on cut samples. On the basis of both types of samples, approximately 75 percent of the bales were Middling or higher in grade, and 14 percent were classed Strict Low Middling (table 1).

Greater differences in grade distribution were prevalent, however, when the bales were subdivided by origin and type of gin bale. Light Spotted grades were assigned to 26 percent of the Texas bales on the basis of cut samples, but only 15 percent of these bales were assigned these grades on the basis of mechanical samples. Twenty percent of the cut samples from the California flat bales were classed Middling Plus and Strict Middling, whereas only 5 percent of the mechanical samples were assigned these grades. For California gin standard bales, 25 percent of the cut samples and 44 percent of the mechanical samples were classed Strict Middling.

These differences in grade distribution show that occasionally the higher grade was assigned to mechanically drawn samples, while in others to the cut samples. For a large number of bales including a wide range of grades, the effect of these differences may tend to offset one another and, on an average, be of little economic importance to the producer. However, for producers selling only a few bales, such differences could significantly affect the average price received for cotton.

Thus, for any given lot of cotton, the proportion of mechanical samples grading higher, the same as, and lower than cut samples are of economic importance to producers and other segments of the cotton trade. The mechanical sample and cut sample from the same bale were assigned identical grades for 69 percent of the 800 bales studied (fig. 1). This was only slightly less than the proportion of bales for which

Table 1.--Distribution of grades assigned to mechanically drawn and cut samples from 800 bales of cotton, by origin and type of gin bale, 1959 crop

Grade classification	Texas flat		California flat		California gin standard		All bales	
	Mechanical sample	Cut sample	Mechanical sample	Cut sample	Mechanical sample	Cut sample	Mechanical sample	Cut sample
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Strict Middling	1	--	2	5	44	25	12	8
Middling Plus	--	--	3	15	6	23	3	11
Middling	44	42	91	78	37	33	60	55
Strict Low Middling Plus	1	--	2	1	11	10	5	3
Strict Low Middling	37	31	2	1	2	9	14	14
Strict Middling Light Spotted	1	1	--	--	--	--	1/	1/
Middling Light Spotted	6	13	--	--	--	--	2	5
Strict Low Middling Light Spotted	8	11	--	--	--	--	3	4
Low Middling Light Spotted	--	1	--	--	--	--	--	1/
Strict Middling Light Grade	2	1	--	--	--	--	1	1/
Total, all grades	100	100	100	100	100	100	100	100

1/ Less than one-half of 1 percent.

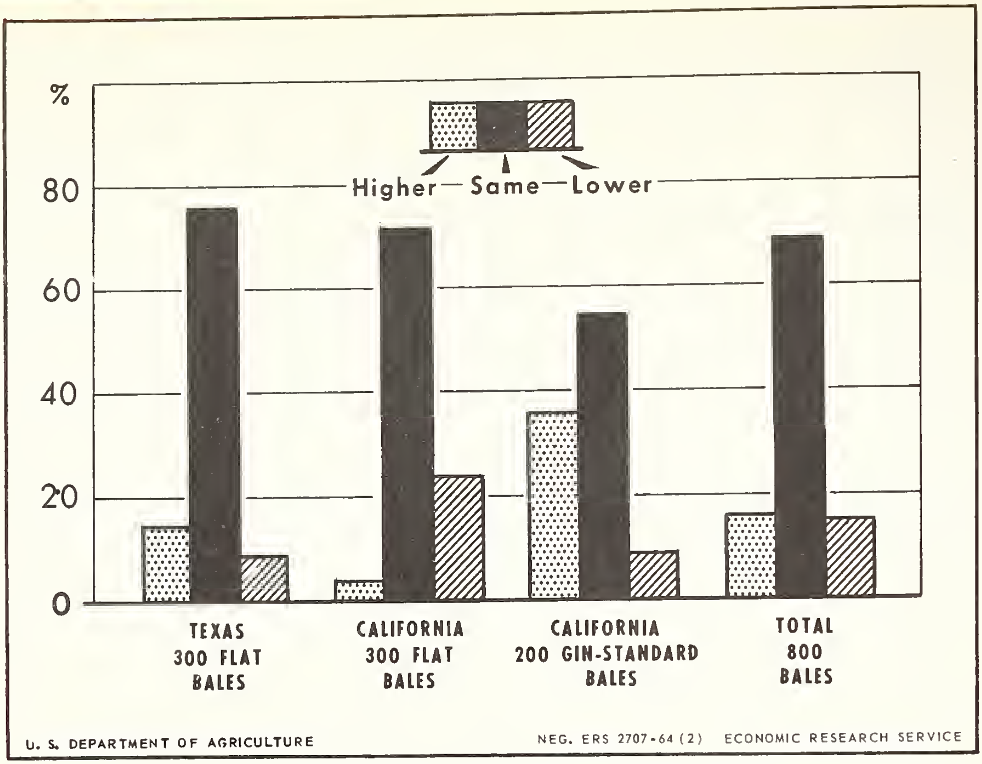

Figure 1.--Mechanical samples assigned higher, same, or lower grades than cut samples, 800 gin-packaged bales, by origin and type of bale, 1959 crop

similar cut samples were assigned the same grade. For the remaining bales, about half of the mechanical samples were graded higher and the other half lower than the grade assigned cut samples.

The two types of samples were assigned identical grades for 76 and 72 percent of the gin flat bales from Texas and California, respectively. Mechanically drawn samples were assigned higher grades for about two-thirds of the remaining Texas bales, but were graded lower for a large majority of the remaining California flat bales. The two samples were assigned the same grade for only 55 percent of the California gin standard bales, with mechanical samples grading higher than cut samples for about four-fifths of the remaining bales.

Some of the differences among groups of bales in the proportions of mechanical samples classed higher or lower than cut samples may have been due to differences in type of gin bale; some to the differences in quality characteristics, and hence the actual grade, of the bales included in each group; and some to the difference between the two types of samples in accurately representing or reflecting the actual grades of the bales. For the Texas bales, mechanical samples tended to be classed the same as or higher than cut samples which had been assigned one of the Light Spotted grades (fig. 2). Of the bales classed Middling Light Spotted on the basis of cut samples, 41 percent were classed Middling and 23 percent were classed Strict Low Middling, on the basis of mechanical samples (appendix, table 14). Similarly, 44 percent of the bales which were classed Strict Low Middling Light Spotted on the basis of cut samples were classed Strict Low Middling on the basis of mechanical samples. Possibly the several small portions of lint constituting the mechanical sample tended to diffuse or blend the

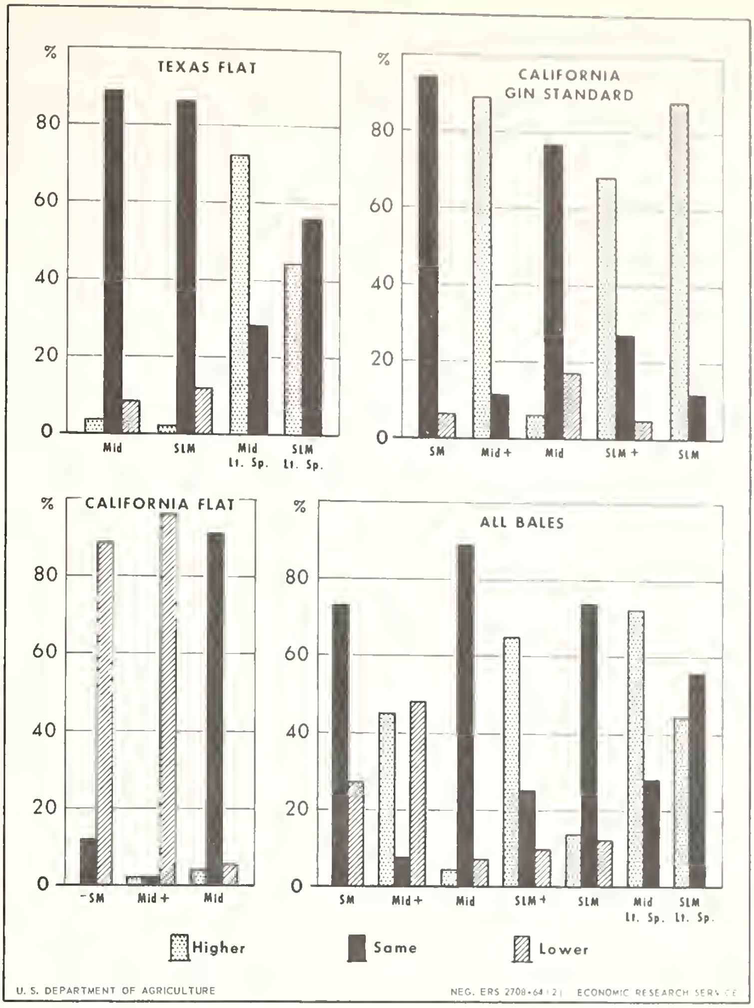

Figure 2.--Mechanical samples assigned higher, same, or lower grades than cut samples, by origin, type of gin bale, and grade of cut sample, 1959 crop.

"spots" to the extent that they were not as distinct or visible to the classer. Hence, the mechanical sample was generally assigned a higher grade than that assigned to the cut sample from the same bale.

A large proportion of the California gin standard bales which were assigned Middling Plus and Strict Low Middling Plus on the basis of cut samples were assigned Strict Middling and Middling grades, respectively, on the basis of mechanical samples. Since, by definition, the cut samples also reflected the color of Strict Middling and Middling cotton, it appears that these differences in grade classification were primarily due to the difference in amount or appearance of leaf and other trash in the two types of samples. 5/

5/ Middling Plus is cotton which is Middling average or better in leaf and preparation with Strict Middling or better color. Strict Low Middling Plus is cotton which is Strict Low Middling average or better in leaf and preparation with Middling or better color (4, p. 22).

Unlike the gin standard bales, a large majority of the California flat bales which were classed Middling Plus on the basis of cut samples were classed Middling on the basis of mechanical samples. Also, about three-fourths of the California flat bales which were classed Strict Middling on the basis of cut samples were classed Middling on the basis of mechanical samples. However, most of the gin standard bales classed Strict Middling on the basis of cut samples were also classed Strict Middling on the basis of mechanical samples. Data were not available to determine if these differences were due to type of bale, as these two comparisons imply.

Such an explanation is contradicted, however, by the finding that for both groups of California bales as well as for Texas bales, a large majority of cut samples classed Middling were also classed Middling on the basis of mechanical samples. Similarly, if we consider the 800 bales as a whole, a majority of the cut samples assigned the Strict Low Middling grade were also assigned the same grade on the basis of mechanical samples. Most of the differences in grade between types of samples occurred when split grades were involved.

Often, when the two types of samples were assigned different grades, these differences were equivalent to one-half grade. However, because of small differences in price among various grades of high-quality cotton compared with low-quality cotton, the half-grade differences were of greatest economic significance for lower grades of White cotton and for Light Spotted cotton. For example, bales classed Middling Plus and worth 31.19 cents per pound on the basis of cut samples were worth an average of 28 points less to 32 points more if the mechanical samples were assigned lower or higher grades, respectively (table 2). In comparison, bales classed Strict Low Middling on the basis of cut samples were worth an average of 75 points less to 150 points more on the basis of mechanical samples.

Table 2.--Difference in grade value per pound between mechanically drawn and cut samples which were assigned different grades, by grade assigned to cut sample, 1959 crop

Grade assigned to cut sample	Average grade value of--			Difference in grade value between cut and mechanical samples classed--	
	Cut sample	Mechanical samples classed--			
		Lower	Higher	Lower	Higher
	Cents	Cents	Cents	Cents	Cents
Strict Middling	31.51	31.02	--	0.49	--
Midling Plus	31.19	30.91	31.51	.28	0.32
Middling	30.96	29.39	31.34	1.57	.38
Strict Low Middling Plus	29.70	28.83	30.96	.87	1.26
Strict Low Middling	28.83	28.08	30.33	.75	1.50
Low Middling Plus	27.89	--	31.19	--	3.30
Middling Light Spotted	28.71	--	30.10	--	1.39
Strict Low Middling Light Spotted	27.32	--	28.83	--	1.51
Low Middling Light Spotted	25.72	--	28.83	--	3.11

Differences in grade between mechanical and cut samples for all 800 bales combined averaged only 6 points per pound in grade value (table 3). Statistically, this difference was not significant. Differences in grade value were greater, and significant, for each of the three subgroups of bales. Although the differences did not average more than $1 per bale for any subgroup, they were considerably greater than the differences based on the two cut samples. Grade value based on mechanical samples was less than that based on cut samples for the California flat bales, whereas the reverse was true for the other two groups of bales.

Table 3.--Average grade, color, staple length, and value of 800 bales of cotton based on mechanically drawn samples and samples cut from gin-packaged bales, by origin and type of gin bale, 1959 crop

Quality factor, origin, and type of gin bale	Unit	Mechanical sample	Cut sample	Difference 1/
Grade value per pound: 2/				
Texas flat	Cent	29.70	29.56	0.14*
California flat	do.	30.94	31.05	-.11*
California gin standard	do.	31.04	30.85	.19**
All bales	do.	30.50	30.44	.06
Reflectance:				
Texas flat	Rd	74.5	74.3	.2
California flat	do.	77.1	77.3	-.2
California gin standard	do.	77.8	78.0	-.2
All bales	do.	76.3	76.4	-.1
Yellowness:				
Texas flat	+b	8.4	8.5	-.1
California flat	do.	7.9	8.0	-.1
California gin standard	do.	8.1	8.1	.0
All bales	do.	8.2	8.2	.0
Staple length:				
Texas flat	1/32 inch	31.35	31.40	-.05
California flat	do.	33.99	34.00	-.01
California gin standard	do.	33.96	34.00	-.04
All bales	do.	32.99	33.02	-.03
Value per pound: 3/				
Texas flat	Cent	29.28	29.21	.07
California flat	do.	32.36	32.49	-.13**
California gin standard	do.	32.46	32.28	.18**
All bales	do.	31.23	31.21	.02

1/ Mechanically drawn sample compared with cut sample; * and ** indicate differences were significant at the 5 percent and 1 percent levels, respectively. 2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents. 3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

Differences in average reflectance and average yellowness were not significant and did not support the differences in average grade between the two types of samples (table 3). Differences between types of samples for both of these color attributes were generally small and not significant even for individual bales in grade classification by one or more grades. Furthermore, there was no evidence that either type of sample would consistently provide superior color tests results.

This suggests that the differences in grades assigned to the two types of samples may have been primarily due to actual differences in trash content of the two samples, or to differences in the apparent prominence of trash. It is conceivable that a mechanically drawn sample from a given bale could contain either more or less trash than a cut sample. This would depend on whether the sampler valve opens into a part of the flue normally, but carries relatively cleaner or trashier lint. It is also conceivable that there is no actual difference in trash content of the two types of samples, but that because of the "compressing" action of the mechanical sampler, or because of some deficiency in the method of drawing and handling cut samples, there could be a substantial difference in the appearance of trash in the two samples.

On an average, staple length based on mechanically drawn samples was slightly less than that based on cut samples (table 3). However, the differences were not statistically significant, and for all bales combined the difference between mechanical and cut samples was the same as the difference between averages for the two cut samples. Hence, compared with differences in grade, differences in staple length between the two types of samples had relatively little effect on the value of the bales studies. For all 800 bales, value based on appropriate price differences for both grade and staple length of mechanical samples averaged 2 points per pound, or 10 cents a bale, greater than the value based on cut samples (table 3). 6/ This was less than the difference in average values between the two similar cut samples and was not significant.

Fiber, Processing, and Dyeing Properties

Although grade and staple length are the major determinants of price received by cotton producers, and serve as the basis for many subsequent transactions occurring between first buyers and spinners, more and more emphasis is being given to fiber properties other than grade and staple. Because of their growing importance, differences in these other fiber properties as reflected by mechanical and cut samples were evaluated.

There were no differences between the two types of samples for average fineness, sugar content, and uniformity ratio for any of the three groups of bales (table 4). For all groups combined, there were minor but nonsignificant differences between the two samples in nonlint content, mean length (array method), coefficient of length variation, and fiber length distribution.

There was a tendency for the strength and appearance of yarn made from mechanical samples to exceed that of yarn from cut samples whereas there was no difference with regard to neps (table 5). With respect to dyeing properties, the greatest differences and those with any possible significance between types of samples were found for yarns dyed blue after bleaching.

6/ Appropriate prices were computed from the 14-market average premiums and discounts for the 1960-61 season (6).

Table 4.--Fiber properties of 800 bales of cotton based on mechanically drawn and cut samples, by origin and type of gin bale, 1959 crop

Fiber property	Unit	Texas flat			California flat			California gin standard			All bales		
		Mechanical sample	Cut sample	Difference 1/	Mechanical sample	Cut sample	Difference 1/	Mechanical sample	Cut sample	Difference 1/	Mechanical sample	Cut sample	Difference 1/
Nonlint content	Percent	2.3	2.5	-0.2	2.0	2.0	0	2.2	2.3	-0.1	2.2	2.3	-0.1
Micronaire	Reading	3.7	3.7	0	4.6	4.6	0	4.4	4.4	0	4.2	4.2	0
Fiber strength:													
"0" gauge	1,000 psi	75	75	0	95	94	1	97	98	-1	88	88	0
1/8" gauge	Grams/tex	20.7	20.7	0	25.3	25.2	.1	25.9	25.8	.1	23.7	23.7	0
Sugar content	Percent	.4	.4	0	.2	.2	0	.2	.2	0	.3	.3	0
Acid-alkaline	pH	6.6	6.6	0	6.9	6.9	0	6.9	7.0	-.1	6.8	6.8	0
Fibrograph data:													
Upper half mean	Inch	.97	.97	0	1.07	1.07	0	1.07	1.06	.01	1.03	1.03	0
Mean length	do.	.76	.75	.01	.86	.86	0	.86	.86	0	.82	.82	0
Uniformity ratio	Percent	78	78	0	81	81	0	80	80	0	80	80	0
Array data:													
Upper quartile	Inch	1.10	1.09	.01	1.20	1.19	.01	1.19	1.19	0	1.16	1.16	0
Mean length	do.	.89	.88	.01	1.00	.99	.01	.99	.98	.01	.96	.94	.02
Coef. of variation	Percent	32	33	-1	28	29	-1	30	30	0	30	31	-1
Fibers which were-													
Over 1 inch	do.	40	39	1	62	60	2	59	59	0	53	52	1
½ to 1 inch	do.	47	48	-1	30	32	-2	32	31	1	37	[illegible]	-1
Under ½ inch	do.	13	13	0	8	8	0	9	10	-1	10	10	[illegible]

1/ Mechanical sample compared to cut sample.

Table 5.--Processing and dyeing properties of 800 bales of cotton based on mechanically drawn and cut samples, by origin and type of gin bale, 1959 crop

Processing and dyeing property	Unit	Texas flat			California flat			California gin standard			All bales		
		Mechanical sample	Cut sample	Difference 1/	Mechanical sample	Cut sample	Difference 1/	Mechanical sample	Cut sample	Difference 1/	Mechanical sample	Cut sample	Difference 1/
Processing waste 2/	Percent	8.16	8.46	-0.30	6.52	6.73	-0.21	7.10	7.24	-0.14	7.28	7.51	-0.23
Nep count 3/	Number	16	17	-1	10	9	1	10	10	0	12	12	0
Yarn strength, 22s	Pound	106	104	2	133	132	1	138	135	3	124	122	2
Yarn strength, 50s	do.	37	36	1	48	47	1	50	58	2	44	43	1
Break factor 4/	Number	2079	2039	40	2677	2645	32	2770	2691	79	2476	2429	47
Yarn appearance	Index	88	85	3	103	101	2	99	96	3	96	94	2
Yarn color:													
Gray yarn:													
Reflectance	Rd	68.4	68.6	-.2	72.2	72.4	-.2	73.0	73.1	-.1	71.0	71.2	-.2
Yellowness	+b	11.1	11.1	0	11.2	11.2	0	11.2	11.2	0	11.2	11.1	.1
Index	Number	93	94	-1	101	101	0	102	102	0	98	98	0
Bleached yarn:													
Reflectance	Rd	82.1	81.0	.1	83.5	83.7	-.2	84.2	84.8	-.6	83.2	83.4	-.2
Yellowness	+b	3.3	3.1	.2	3.0	2.9	.1	2.9	3.0	-.1	3.1	3.0	.1
Index	Number	98	98	0	102	102	-1	104	105	-1	101	101	0
Dyed yarn: 5/													
Reflectance	Rd	25.9	25.5	.4	27.0	26.6	.4	26.2	25.9	.3	26.4	26.0	.4
Blueness	-b	26.4	26.7	-.3	26.4	26.8	-.4	27.0	27.4	-.4	26.6	26.9	-.3
Index	Number	107	109	-2	106	107	-1	110	111	-1	107	109	-2

1/ Mechanical sample compared to cut sample.
2/ Total picker and card waste.
3/ Neps per 100 square inches of card web.
4/ For 22s and 50s yarns.
5/ Dyed blue after bleaching.

MECHANICAL SAMPLES COMPARED WITH SAMPLES CUT FROM COMPRESSED BALES

Many warehouses compress gin-flat bales to standard density soon after they arrive in the warehouses in order to conserve storage space and to facilitate filling subsequent shipping orders to domestic mills. Thus, many requests for new samples have to be filled by cutting samples after the bales are compressed. Because of this practice, mechanically drawn samples were compared with samples cut from bales soon after compression.

Of the 400 gin-packaged flat bales compressed to standard density, 84 percent were assigned the same grade on the basis of mechanical samples and samples cut after compression (fig. 3). Half of the mechanical samples from remaining bales were classed higher and half lower than cut samples from the same bales. By subgroups, 76 percent of the Texas bales and 92 percent of the California bales were assigned identical grades.

There was no difference in average grade value between mechanical and compressed-bale cut samples for the 400 bales (table 6). For the 200 Texas bales, grade value based on mechanical samples averaged 30 cents a bale greater than that based on compressed-bale cut samples, while for the 200 California bales grade value based on mechanical samples averaged 35 cents a bale lower. On the basis of these findings, mechanical samples seem to be as reliable as cut samples for determining grade of compressed bales which have been stored only a few months.

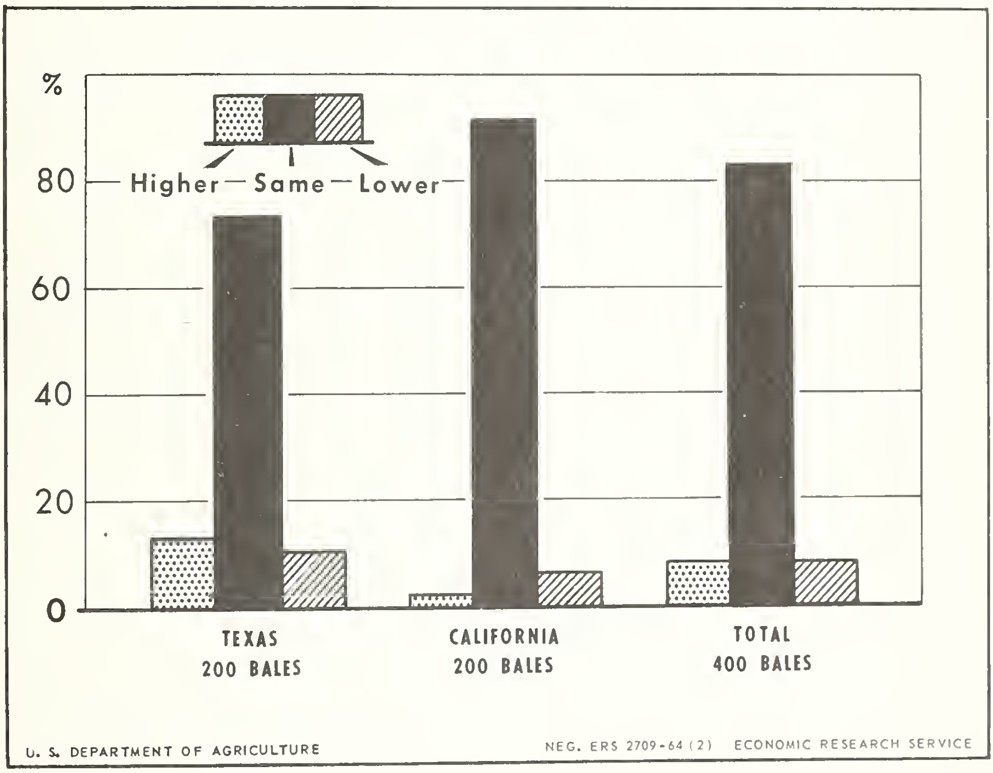

Figure 3.--Mechanical samples assigned higher, same, or lower grade than samples cut after flat bales were compressed to standard density, by origin, 1959 crop.

Table 6.--Average grade, color, staple length, and value of 400 bales of cotton based on mechanically drawn samples and samples cut after warehouse compression, by origin, 1959 crop

Quality factor and origin	Unit	Mechanical sample	Cut sample	Difference 1/
Grade value per pound: 2/				
Texas	Cent	29.68	29.62	0.06
California	do.	30.91	30.98	-.07
All bales	do.	30.30	30.30	.00
Reflectance:				
Texas	R_d	74.3	74.8	-.5**
California	do.	77.1	78.0	-.9**
All bales	do.	75.7	76.4	-.7**
Yellowness:				
Texas	+b	8.4	8.2	.2**
California	do.	8.0	7.8	.2*
All bales	do.	8.2	8.0	.2**
Staple length:				
Texas	1/32 inch	31.40	31.44	-.04
California	do.	33.98	34.00	-.02
All bales	do.	32.69	32.72	-.03
Value per pound: 3/				
Texas	Cent	29.30	29.26	.04
California	do.	32.32	32.42	-.10*
All bales	do.	30.81	30.84	-.03

1/ Mechanically drawn sample compared with cut sample; * and ** indicate differences were significant at the 5 percent and 1 percent levels, respectively.
2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents.
3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

Average reflectance for mechanical samples was .7 R_d unit lower and average yellowness was .2 of a +b unit higher than they were for compressed-bale cut samples (table 6). Statistically, these differences were significant, although differences this small are not clearly distinguishable by classers.

Staple length of mechanically drawn samples was consistently, but only slightly, lower than that obtained from compressed-bale cut samples. Like grade, the differences in average staple length between the two types of samples were not significant.

The value of the 400 bales, based on both grade and staple length, averaged 30.81 cents a pound on the basis of mechanical samples and 30.84 cents a pound on the basis of the compressed-bale cut samples. This difference was equivalent to only 15 cents a bale, and was not statistically significant. It was approximately equal in magnitude to differences in average values between other pairs of samples which were compared in this study.

USEFULNESS OF STORED MECHANICAL SAMPLES FOR EVALUATING QUALITY OF BALES STORED 2 YEARS

Freshly cut samples are generally used as the basis for quality and pricing decisions in merchandising stored cotton. Therefore, they were used in this study as the standard for judging the usefulness of stored mechanical samples for determining the quality of bales which had been stored 2 years. The usefulness of stored cut samples for similar purposes was analyzed in the report on the first phase of this research. The findings of the first phase indicated that stored cut samples were comparable to freshly cut samples for evaluating the quality of cotton held in storage up to approximately 6 months. After both 1 and 2 years of storage, grade and yellowness based on the stored cut samples differed significantly from evaluations based on fresh samples for a majority of the ten 100-bale lots studied. However, for all 1,000 bales combined, differences between stored cut and freshly cut samples were generally small.

Values based on cut samples stored for 1 year averaged 10 cents per bale less than values based on freshly cut samples, and at the end of 2 years of storage averaged 95 cents per bale less. For staple and fiber length, fineness, fiber and yarn strength, and neps, differences between stored cut and freshly cut samples were generally inconsistent and not significant after 2 years of storage.

Grade, Staple Length, and Value

Grades assigned to stored mechanical samples were generally lower than those assigned to samples freshly cut from bales that had been stored for 2 years. The distribution of grades for all 800 stored bales was as follows: 44 percent of the stored mechanical samples were assigned White grades; 40 percent were Light Spots; and 16 percent were assigned Spotted, Tinged, or Stained grades (table 7). In comparison, 52 percent of the freshly cut samples were assigned White grades, 39 percent Light Spots, and only 9 percent Spotted, Tinged, or Stained. Similar differences in grade distribution were also prevalent for the three subgroups of bales.

Assuming freshly cut samples as an acceptable standard, stored mechanical samples were unreliable for reflecting the grade of Texas bales stored for 2 years. These two sets of samples were assigned the same grade for only 45 percent of the Texas bales, and stored mechanical samples were assigned a lower grade than freshly cut samples for another 45 percent of these bales (fig. 4). The same grade was assigned to both types of samples for 52 percent of the California flat bales, and for 68 percent of the gin standard bales. For all 800 bales combined, identical grades were assigned to 54 percent while for 33 percent the stored mechanical sample was graded lower than the freshly cut sample.

These differences in grade between the two types of samples were statistically significant. For all bales combined, the average grade value based on stored mechanical samples was 33 points less than the average grade value based on freshly

Table 7.--Distribution of grades assigned to mechanically drawn samples stored 2 years and to samples freshly cut from bales stored 2 years, by origin and type of gin bale, 1959 crop

Grade classification	Texas flat		California flat		California gin standard		All bales	
	Stored mechanical sample	Freshly cut sample	Stored mechanical sample	Freshly cut sample	Stored mechanical sample	Freshly cut sample	Stored mechanical sample	Freshly cut sample
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Strict Middling	1	1	55	57	39	49	31	34
Middling Plus	--	--	9	10	7	7	5	6
Middling	1/	1/	11	21	17	16	7	12
Strict Low Middling Plus	--	--	--	--	2	--	1	--
Strict Low Middling	--	1/	--	--	--	--	--	1/
Good Middling Light Spotted	--	--	--	--	1/	--	1/	--
Strict Middling Light Spotted	25	34	20	10	14	9	20	19
Middling Light Spotted	27	27	5	2	21	19	17	16
Strict Low Middling Light Spotted	9	12	--	--	--	--	3	4
Low Middling Light Spotted	1/	--	--	--	--	--	1/	--
Strict Middling Spotted	2	1	--	--	--	--	1	1
Middling Spotted	18	19	--	--	--	--	7	7
Strict Low Middling Spotted	9	1	--	--	--	--	4	1/
Middling Tinged	7	3	--	--	--	--	3	1
Strict Low Middling Tinged	1	1	--	--	--	--	1	1/
Middling Stained	1	1	--	--	--	--	1/	1/
Total, all grades	100	100	100	100	100	100	100	100

1/ Less than one-half of 1 percent.

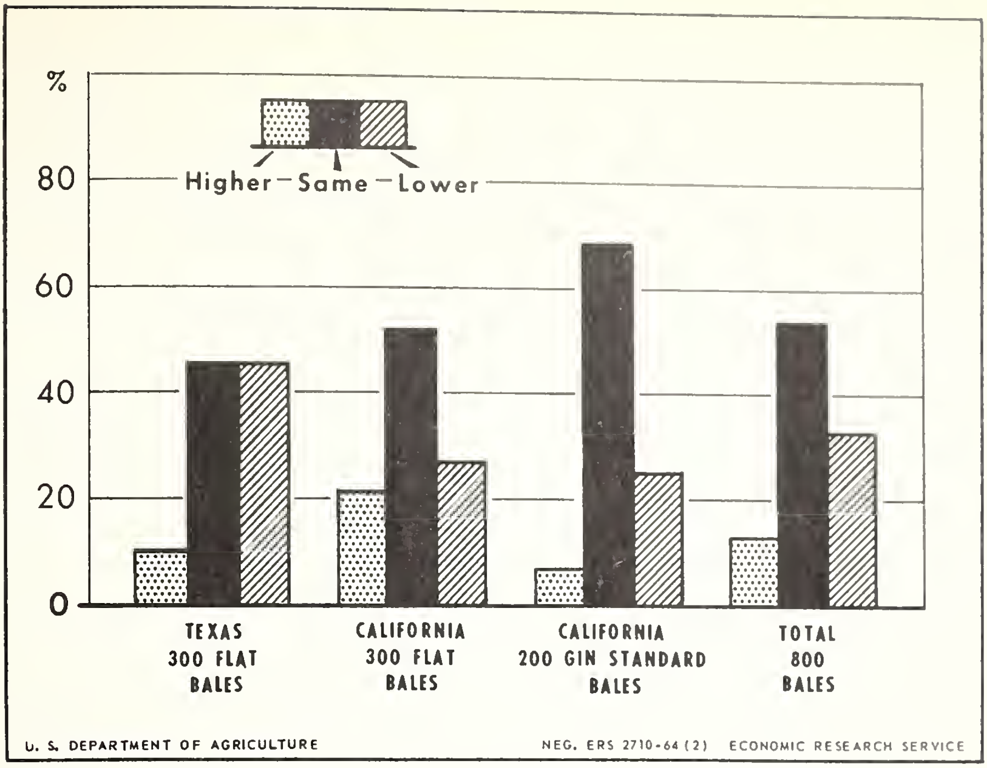

Figure 4.--Mechanical samples stored 2 years assigned higher, same, or lower grade than fresh samples cut from bales stored 2 years, by origin and type of gin bale, 1959 crop.

cut samples (table 8). For subgroups, average grade value based on stored mechanical samples was less than that of freshly cut samples by 56, 21, and 17 points for Texas flat and for California flat and gin standard bales, respectively.

Differences in grade classifications between the two types of samples were substantiated by significant differences in both average reflectance and average yellowness of the samples. Reflectance of stored mechanical samples averaged .7 R_d unit less than the reflectance of freshly cut samples for both groups of flat bales, and was less by .6 R_d unit for all bales combined (table 8). Yellowness of stored mechanical samples averaged 10.4 +b units compared with an average of 9.9 +b units for freshly cut samples.

Staple lengths assigned to stored mechanical samples were shorter than those assigned to freshly cut samples for the two groups of flat bales, whereas there was no difference between the two types of samples for the California gin standard bales. For Texas flat bales, the average difference was almost 0.3 of 1/32 of an inch.

With lower grades and shorter staples, the average value based on stored mechanical samples was significantly lower than that based on freshly cut samples (table 8). The differences in value averaged $3.55 a bale for the Texas cotton, and $1.25 and $1.05 a bale for California flat and gin standard bales, respectively.

Table 8.--Average grade, color, staple length, and value of 800 stored bales based on mechanically drawn samples stored 2 years and fresh samples cut from bales stored 2 years, by origin and type of gin bale, 1959 crop

Quality factor, origin, and type of gin bale	Unit	Stored mechanical sample	Freshly cut sample	Difference 1/
Grade value per pound: 2/				
Texas flat	Cent	27.78	28.34	-0.56**
California flat	do.	30.93	31.14	-.21**
California gin standard	do.	30.53	30.70	-.17**
All bales	do.	29.65	29.98	-.33**
Reflectance:				
Texas flat	R_d	73.4	74.1	-.7**
California flat	do.	76.5	77.2	-.7**
California gin standard	do.	77.4	77.7	-.3**
All bales	do.	75.6	76.2	-.6**
Yellowness:				
Texas flat	+b	10.5	10.1	.4**
California flat	do.	10.3	9.7	.6**
California gin standard	do.	10.6	10.1	.5**
All bales	do.	10.4	9.9	.5**
Staple length:				
Texas flat	1/32 inch	30.71	30.99	-.28*
California flat	do.	34.00	34.06	-.06
California gin standard	do.	34.07	34.07	.00
All bales	do.	32.78	32.91	-.13*
Value per pound: 3/				
Texas flat	Cent	27.06	27.77	-.71**
California flat	do.	32.36	32.61	-.25**
California gin standard	do.	31.91	32.12	-.21**
All bales	do.	30.26	30.67	-.41**

1/ Stored mechanical sample compared with freshly cut sample from bales stored 2 years * and ** indicate differences were significant at the 5 percent and 1 percent levels, respectively.

2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents.

3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

Effects of Storage Location and Density of Bales

Storage location, considered alone, had a very pronounced effect on the usefulness of stored mechanical samples for merchandising purposes. For bales stored in both Lubbock and Houston, Tex., grade value based on stored mechanical samples averaged approximately \$2.50 a bale less than the value based on fresh samples (appendix, table 15). In contrast, there was no difference in average grade value between stored mechanical samples and freshly cut samples for the 300 bales stored in Bakersfield, Calif. Differences in grade, reflectance, yellowness, staple length, and value between the two sets of samples were greater for bales stored in Houston than for bales stored in either Lubbock or Bakersfield.

Without regard to any other variable, density of bale also affected the usefulness of stored mechanical samples for evaluating quality of stored bales. Differences in quality characteristics based on the two types of samples were greater for compress standard density bales than for gin flat or gin standard density bales (appendix, table 16). Differences in grade, reflectance, and staple length were smallest for gin standard bales, while differences in yellowness were smallest for gin flat bales. As a result, the difference in value per pound between stored mechanical and freshly cut samples was 21 points for gin standard bales, 34 points for flat bales, and 55 points for compress standard bales.

The combined effect of storage location and bale density on quality differences between stored mechanical and freshly cut samples was ascertained by comparisons among the eight different stored lots. The difference in average grade value between the two sets of samples was 1.8 times greater for compress standard bales stored in Houston than for similar bales from the same cottons stored in Lubbock (table 9). The difference in grade value between the two sets of samples was negligible and not significant for compress standard bales stored in Bakersfield. But for similar bales selected from the same cottons and stored in Houston, the difference in grade value between samples amounted to \$3.40 a bale. Differences in reflectance for California cotton tended to be greater for Houston-stored bales than for similar bales stored in Bakersfield, whereas it appeared that density had a greater effect than storage location on differences in yellowness for these bales.

Fiber, Processing, and Dyeing Properties

Although differences in grade, color, staple length, and value between stored mechanical samples and freshly cut samples were sufficiently large to be of economic importance, differences in fiber, processing, and dyeing properties based on the two samples were generally negligible and inconsistent (tables 10 and 11). One exception was the difference in nep count, which for all bales combined, stored mechanical samples averaged 22 neps per 100 square inches of card web compared with an average of 29 neps for freshly cut samples. This difference is considerably greater than the standard error of $\pm$ 2.9 neps computed by the Cotton Division in determining the reproducibility of nep count test results (4).

The differences between samples in reflectance and yellowness of lint cotton were apparently too minor to have any appreciable influence on yarn color. There was no difference between stored mechanical and freshly cut samples in yarn color index for gray and bleached yarns, and a difference of only one index point for yarns dyed blue after bleaching.

Table 9.--Difference in quality characteristics between mechanically drawn samples stored 2 years and fresh samples cut from bales stored 2 years, by origin, storage location, and density of stored bale, 1959 crop

Origin, storage location, and density	Difference between stored mechanical and freshly cut sample for-- 1/				
	Grade value per pound 2/	Reflectance	Yellowness	Staple length	Value per pound 3/
	Cents	R_d	+b	1/32 inch	Cents
Texas					
Lubbock flat	-0.67**	-0.5**	0	-0.19	-0.73**
Lubbock compress standard	-.36**	-.9**	.4**	.16	-.31*
Houston compress standard	-.66**	-.7**	.7**	-.81**	-1.09**
California					
Bakersfield flat	.06	-.3**	.4**	-.09**	.04
Bakersfield compress standard	.01	-.6**	.8**	-.03	.01
Houston compress standard	-.68**	-1.2**	.8**	-.05*	-.81**
Bakersfield gin standard	-.09**	-.2**	.5**	-.07	-.14**
Houston gin standard	-.24**	-.5**	.5**	.07*	-.27*

1/ Mechanical sample stored 2 years compared with fresh sample cut from bales stored 2 years; * and ** indicate differences were significant at the 5 percent and 1 percent levels, respectively.

2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents.

3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

Table 10.--Fiber properties of 800 stored bales based on mechanically drawn samples stored 2 years and fresh samples cut from bales stored 2 years, by origin and type of gin bale, 1959 crop

Fiber property	Unit	Texas flat			California flat			California gin standard			All bales		
		Stored mechanical sample	Freshly cut sample	Difference 1/	Stored mechanical sample	Freshly cut sample	Difference 1/	Stored mechanical sample	Freshly cut sample	Difference 1/	Stored mechanical sample	Freshly cut sample	Difference 1/
Nonlint content.....	Percent	2.4	2.2	2.0	2.3	2.2	0.1	2.4	2.4	0	2.4	2.3	0.1
Micronaire..........	Reading	3.7	3.6	.1	4.6	4.6	0	4.6	4.4	.2	4.2	4.2	0
Fiber strength:													
"0" gauge.........	1,000 psi	76	77	-1	96	95	1	96	96	0	88	88	0
1/8" gauge........	Grams/tex	20.9	21.8	-.9	26.1	26.4	-.3	26.0	26.8	-.8	24.1	24.8	-.7
Sugar content.......	Percent	.3	.3	0	.2	.2	0	.2	.2	0	.2	.2	0
Acid-alkaline.......	pH	6.6	6.5	.1	6.8	6.9	-.1	6.8	6.7	.1	6.7	6.7	0
Fibrograph data:													
Upper half mean...	Inch	.98	.97	.01	1.06	1.06	0	1.06	1.05	.01	1.03	1.02	.01
Mean length.......	do.	.76	.74	.02	.85	.01	.84	.84	.84	0	.82	.80	.02
Uniformity ratio..	Percent	77	77	0	80	80	0	80	80	0	79	79	0
Array data:													
Upper quartile....	Inch	1.10	1.09	.01	1.21	1.20	.01	1.21	1.19	.02	1.17	1.16	.01
Mean length.......	do.	.87	.87	0	1.01	1.00	.01	1.02	.98	.04	.96	.94	.02
Coef. of variation	Percent	33	34	-1	29	28	1	28	30	-2	30	31	-1
Fibers which were--													
Over 1 inch.....	do.	40	38	2	60	60	0	63	59	4	54	52	2
½ to 1 inch.....	do.	47	48	-1	33	32	1	29	31	-2	37	38	-1
Under ½ inch....	do.	13	14	-1	7	8	-1	8	10	-2	9	10	-1

1/ Stored mechanical sample compared with freshly cut sample.

Table 11.-Processing and dyeing properties of 800 stored bales based on mechanically drawn samples stored 2 years and fresh samples cut from bales stored 2 years, by origin and type of gin bale, 1959 crop

Processing and dyeing property	Unit	Texas flat			California flat			California gin standard			All bales		
		Stored mechanical sample	Freshly cut sample	Difference 1/	Stored mechanical sample	Freshly cut sample	Difference 1/	Stored mechanical sample	Freshly cut sample	Difference 1/	Stored mechanical sample	Freshly cut sample	Difference 1/
Processing waste 2/	Percent	8.05	8.11	-0.06	6.87	6.79	0.08	6.77	7.02	-0.25	7.29	7.34	-0.05
Nep count 3/	Number	30	39	-9	18	22	-4	19	25	-6	22	29	-7
Yarn strength, 22s	Pound	102	100	2	129	128	1	132	132	0	120	118	2
Yarn strength, 50s	do.	38	37	1	50	50	0	52	52	0	46	46	0
Break factor 4/	Number	2058	2029	29	2683	2666	17	2766	2739	27	2469	2445	24
Yarn appearance	Index	90	89	1	105	105	0	97	102	-5	97	98	-1
Spinning potential	Yarn No.	52	51	1	68	66	2	69	69	0	62	61	1
Yarn color:													
Gray yarn:													
Reflectance	R_d.	68.3	68.0	.3	73.6	72.8	.8	73.2	72.7	.5	71.6	71.0	.6
Yellowness	+b	12.8	12.7	.1	12.5	12.9	-.4	13.7	13.4	.3	12.9	12.9	0
Index	Number	98	97	1	107	107	0	110	108	2	104	104	0
Bleached yarn:													
Reflectance	R_d.	82.6	82.3	.3	82.5	82.2	.3	82.8	82.4	.4	82.6	82.3	.3
Yellowness	+b	3.0	2.8	.2	2.8	2.6	.2	3.1	2.5	.6	3.0	2.7	.3
Index	Number	100	100	0	100	100	0	100	101	-1	100	100	0
Dyed yarn: 5/													
Reflectance	R_d.	26.4	27.1	-.7	27.0	27.2	-.2	27.1	26.9	.2	26.8	27.1	-.3
Blueness	-b	25.9	25.8	.1	26.1	26.0	.1	26.2	26.1	.1	26.1	26.0	.1
Index	Number	105	103	2	104	104	0	105	104	1	105	104	1

1/ Stored mechanical sample compared with freshly cut sample.
2/ Total picker and card waste.
3/ Neps per 100 square inches of card web.
4/ For 22s and 50s yarns.
5/ Dyed blue after bleaching.

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Table 12.--Average grade, color, staple length, and value of 800 bales of cotton based on 2 similar samples cut from gin-packaged bales, by origin and type of gin bale, 1959 crop

Quality factor, origin, and type of gin bale	Unit	Sample #1	Sample #2	Difference 1/
Grade value per pound: 2/				
Texas flat	Cent	29.56	29.58	-0.02
California flat	do.	31.05	31.05	0
California gin standard	do.	30.85	30.85	0
All bales	do.	30.44	30.45	-.01
Reflectance:				
Texas flat	Rd	74.3	74.4	-.1
California flat	do.	77.3	77.4	-.1
California gin standard	do.	78.0	78.1	-.1
All bales	do.	76.4	76.4	0
Yellowness:				
Texas flat	+b	8.5	8.5	0
California flat	do.	8.0	8.0	0
California gin standard	do.	8.1	8.1	0
All bales	do.	8.2	8.2	0
Staple length:				
Texas flat	1/32 inch	31.40	31.48	-.08
California flat	do.	34.00	34.00	0
California gin standard	do.	34.00	34.00	0
All bales	do.	33.02	33.05	-.03
Value per pound: 3/				
Texas flat	Cent	29.21	29.28	-.07
California flat	do.	32.49	32.50	-.01
California gin standard	do.	32.28	32.28	0
All bales	do.	31.21	31.24	-.03

1/ #1 cut sample compared with #2 cut sample; differences between samples were not significant at the 5 percent and 1 percent levels.
2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents.
3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

Table 13.--Average grade, color, staple length, and value of 400 bales of cotton, based on samples cut after and before warehouse compression, by origin, 1959 crop

Quality factor and origin	Unit	Sample cut after compression	Sample cut before compression	Difference 1/
Grade value per pound: 2/				
Texas	Cent	29.62	29.48	0.14*
California	do.	30.98	31.02	-.04
All bales	do.	30.30	30.25	.05
Reflectance:				
Texas	Rd	74.8	74.1	.7**
California	do.	78.0	77.4	.6**
All bales	do.	76.4	75.8	.6**
Yellowness:				
Texas	+b	8.2	8.6	-.4**
California	do.	7.8	8.0	-.2**
All bales	do.	8.0	8.3	-.3**
Staple length:				
Texas	1/32 inch	31.44	31.49	-.05
California	do.	34.00	34.00	0
All bales	do.	32.72	32.74	-.02
Value per pound: 3/				
Texas	Cent	29.26	29.16	.10
California	do.	32.42	32.46	-.04
All bales	do.	30.84	30.81	.03

1/ Sample cut after compression compared with sample cut before compression; * and ** indicate differences were significant at the 5 percent and 1 percent levels, respectively.

2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents.

3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

Table 14.--Distribution of grade based on mechanical samples, by origin, type of gin bale, and grade assigned to cut sample, 1959 crop

Origin, type of gin bale, and grade of cut sample	Cut samples	Grade of mechanical samples: Strict Middling	Middling Plus	Middling	Strict Low Middling Plus	Strict Low Middling	Strict Middling Lt. Sp.	Middling Lt. Sp.	Strict Low Middling Lt. Sp.	Strict Middling Lt. Gr.
	No.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Texas flat:										
Middling	129	3	--	89	3	3	--	--	--	2
Strict Low Middling	92	--	--	--	--	86	--	7	5	2
Middling Light Spotted	39	--	--	41	--	23	3	28	--	5
Strict Low Middling Light Spotted	34	--	--	--	--	44	--	--	56	--
Other grades	6	--	--	17	--	50	33	--	--	--
California flat:										
Strict Middling	16	12	12	76	--	--	--	--	--	--
Middling Plus	46	2	2	94	--	2	--	--	--	--
Middling	236	1	3	91	3	2	--	--	--	--
Strict Low Middling Plus	1	--	--	--	--	100	--	--	--	--
Strict Low Middling	1	--	--	100	--	--	--	--	--	--
California gin standard:										
Strict Middling	50	94	6	--	--	--	--	--	--	--
Middling Plus	46	89	11	--	--	--	--	--	--	--
Middling	66	1	5	77	16	1	--	--	--	--
Strict Low Middling Plus	20	--	--	68	27	5	--	--	--	--
Strict Low Middling	18	--	--	53	35	12	--	--	--	--
All bales:										
Strict Middling	66	73	8	19	--	--	--	--	--	--
Middling Plus	92	45	7	47	--	1	--	--	--	--
Middling	431	2	2	89	5	2	--	--	--	1/
Strict Low Middling Plus	21	--	--	65	25	10	--	--	--	--
Strict Low Middling	111	--	--	9	5	74	--	5	5	2
Middling Light Spotted	39	--	--	41	--	23	3	28	--	5
Strict Low Middling Light Spotted	34	--	--	--	--	44	--	--	56	--
Other grades	6	--	--	17	--	50	33	--	--	--

1/ Less than one-half of 1 percent.

Table 15.--Average grade, color, staple length, and value of 800 stored bales based on mechanically drawn samples stored 2 years and fresh samples cut from bales stored 2 years, by storage location, 1959 crop

Quality factor and storage location	Unit	Stored mechanical sample	Freshly cut sample	Difference 1/
Grade value per pound: 2/				
Lubbock	Cent	28.04	28.55	-0.51**
Houston	do.	29.05	29.57	-.52**
Bakersfield	do.	31.33	31.33	.00
Reflectance:				
Lubbock	Rd	73.7	74.4	-.7**
Houston	do.	75.1	75.9	-.8**
Bakersfield	do.	77.3	77.6	-.3**
Yellowness:				
Lubbock	+b	10.0	9.8	.2*
Houston	do.	11.1	10.4	.7**
Bakersfield	do.	10.1	9.5	.6**
Staple length:				
Lubbock	1/32 inch	31.02	31.04	-.02
Houston	do.	32.72	32.98	-.26**
Bakersfield	do.	34.02	34.09	-.07
Value per pound: 3/				
Lubbock	Cent	27.47	27.99	-.52**
Houston	do.	29.57	30.29	-.72**
Bakersfield	do.	32.81	32.84	-.03

1/ Mechanical sample stored 2 years compared with fresh sample cut from bales stored 2 years; * and ** indicate differences were significant at the 5 percent and 1 percent levels, respectively.

2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents.

3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

Table 16.--Average grade, color, staple length, and value of 800 stored bales based on mechanically drawn samples stored 2 years and fresh samples cut from bales stored 2 years, by density of bale, 1959 crop

Quality factor and bale density	Unit	Stored mechanical sample	Freshly cut sample	Difference 1/
Grade value per pound: 2/				
Flat	Cent	29.72	30.02	-0.30**
Compress standard	do.	29.17	29.60	-.43**
Gin standard	do.	30.53	30.70	-.17**
Reflectance:				
Flat	R_d	75.5	75.9	-.4**
Compress standard	do.	74.7	75.5	-.8**
Gin standard	do.	77.4	77.7	-.3**
Yellowness:				
Flat	+b	10.0	9.8	.2*
Compress standard	do.	10.6	9.9	.7**
Gin standard	do.	10.6	10.1	.5**
Staple length:				
Flat	1/32 inch	32.36	32.50	-.14*
Compress standard	do.	32.36	32.54	-.18*
Gin standard	do.	34.07	34.07	0
Value per pound: 3/				
Flat	Cent	30.10	30.44	-.34**
Compress standard	do.	29.52	30.07	-.55**
Gin standard	do.	31.91	32.12	-.21**

1/ Mechanical sample stored 2 years compared with fresh sample cut from bales stored 2 years; * and ** indicate differences were significant at the 5 percent and 1 percent levels, respectively.

2/ Based on the grade of each bale with staple length held constant at 1 inch, and the 1960-61, 14-market average premiums and discounts; Middling White, 1 inch = 30.96 cents.

3/ Based on both grade and staple length of each bale, and the 1960-61, 14-market average premiums and discounts.

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